

**I. Amendments to the Claims**

Please amend the claims as indicated in the following listing of the claims, which replaces all prior versions thereof.

1. (Canceled)
2. (Previously Presented) A frequency synthesizer, comprising:  
a phase locked loop comprising:  
an analog mixer phase detector;  
a programmable divider having an input terminal responsive to an output signal of the frequency synthesizer and having an output terminal coupled to an input terminal of the analog mixer phase detector;  
a loop filter having ~~an~~ a first input terminal coupled to an output terminal of the analog mixer phase detector; and  
a voltage controlled oscillator having a control terminal coupled to an output terminal of the loop filter; and  
an auxiliary digital frequency detector having an output terminal coupled to a second input terminal of the loop filter.
3. (Original) The frequency synthesizer of claim 2, wherein the analog mixer phase detector is for detecting a phase difference between the output signal of the programmable divider and a reference signal.

4. (Original) The frequency synthesizer of claim 2, wherein the programmable divider includes a direct digital synthesizer.

5. (Original) The frequency synthesizer of claim 2, wherein the auxiliary digital frequency detector has a first input terminal coupled to the output terminal of the programmable divider.

6. (Original) The frequency synthesizer of claim 5, further comprising a comparator coupled between the output terminal of the programmable divider and the first input terminal of the auxiliary digital frequency detector.

7. (Previously Presented) The frequency synthesizer of claim 5, further comprising a differential integrator circuit coupled between the output terminal of the auxiliary digital frequency detector and the second input terminal of the loop filter.

8. (Previously Presented) The frequency synthesizer of claim 7, wherein the second input terminal of the loop filter is coupled to a timing capacitor such that an output terminal of the differential integrator circuit is coupled to the timing capacitor of the loop filter.

9. (Original) The frequency synthesizer of claim 8, further comprising a steering resistor coupled between the output terminal of the differential integrator circuit and the timing capacitor of the loop filter.

10. (Original) The frequency synthesizer of claim 9, wherein the programmable divider includes a direct digital synthesizer.

11. (Original) The frequency synthesizer of claim 10, further comprising a comparator coupled between the output terminal of the programmable divider and the first input terminal of the auxiliary digital frequency detector.

12. (Original) The frequency synthesizer of claim 10, further comprising a prescaler responsive to the output signal of the frequency synthesizer and coupled to the input terminal of the programmable divider.

13. (Original) The frequency synthesizer of claim 10, further comprising a balun transformer coupled between the output terminal of the programmable divider and the input terminal of the analog mixer phase detector.

14. (Original) The frequency synthesizer of claim 13, further comprising a bandpass filter coupled between the balun transformer and the input terminal of the analog mixer phase detector.

15. (Original) The frequency synthesizer of claim 14, further comprising an amplifier coupled between the bandpass filter and the input terminal of the analog mixer phase detector.

16. (Currently Amended) A frequency synthesizer, comprising:

a phase locked loop comprising:

an analog mixer phase detector;

~~an analog mixer phase detector;~~

a programmable divider having an input terminal responsive to an output signal of the frequency synthesizer and having an output terminal coupled to an input terminal of the analog mixer phase detector;

a loop filter having a first input terminal coupled to an output terminal of the analog mixer phase detector; and

a voltage controlled oscillator having a control terminal coupled to an output terminal of the loop filter; and

means, coupled to a second input terminal of the loop filter, for making the analog mixer phase detector automatically acquire phase lock when the phase locked loop is out of lock.

17. (Canceled)

18. (Currently Amended) The frequency synthesizer of claim ~~18~~ 16, wherein the programmable divider includes a direct digital synthesizer.

19. (Currently Amended) In a frequency synthesizer including a voltage controlled oscillator, a loop filter, and an analog mixer phase detector, a method comprising:

adjusting the voltage applied to the voltage controlled oscillator from the loop filter until the frequency of an output signal of the analog mixer phase detector is within a pass-band of the

loop filter by providing a current to a timing capacitor of the loop filter to cause the voltage supplied to the voltage controlled oscillator to change based on a time constant of the loop filter, wherein the current provided to the timing capacitor of the loop filter is provided from an integrator circuit responsive to an output signal from an auxiliary digital frequency detector whose output signal is related to a phase difference between an output signal of a programmable divider and a reference signal supplied to the auxiliary digital frequency detector, wherein the programmable divider is responsive to an output signal of the frequency synthesizer.

20. (Previously Presented) The frequency synthesizer of claim 2, wherein the auxiliary digital frequency detector is for providing a current to a timing capacitor of the loop filter to cause the voltage supplied to the voltage controlled oscillator to change based on a time constant of the loop filter.